

Bently Nevada Systems Don't Cost ... They Pay



Spain

Bently Nevada recently installed

a 3500 Series Machinery Protection System on a centrifugal compressor

at a chemical plant in Spain. The compressor supplies instrument air to several areas of the plant as well as process air for nitrogen production. In addition to the 3500 System, the compressor and the electric motor driving it were also fitted with a proper complement of XY probes at each bearing (previously, only certain bearings were fitted with single probes).

A week after installation of this new system, operators began to observe very high vibration on stage 4 of the compressor, and the vibration continued to increase over a period of several weeks. The machine was unable to produce sufficient air pressure during this time and supplemental compressors had to be brought in. Eventually, the vibration reached a level that tripped the machine. Upon inspection, a perforation (probably due to corrosion) was found in the compressor that allowed part of the stage 4 discharge to be readmitted into the stage 3 suction, thus reducing its output. The machine was repaired and returned to service. After repair, the outlet air pressure increased 35%, eliminating the need for supplemental compressors and their attendant costs of approximately \$10,000 USD per week.

Without adequate vibration monitoring to trip the machine, it is highly likely that the compressor would

have continued to run at the reduced output pressure, and the failure would have progressed to levels of more severe mechanical damage. More expensive repairs and the need for supplemental air at a minimum of \$10,000 USD per week (or more as output continued to degrade) would have resulted. The more extensive repairs would necessitate additional downtime and the costs of lost production would have further added to the customer's losses. It is safe to assume that the cost of the monitoring system was substantially recouped through this event. This rapid payback is extremely common for machinery that partially or totally impacts a plant's processes.



Sweden

A pulp and paper mill in Sweden

uses a 3300 Series Monitoring

System to detect plate clash on four double-disk pulp refiners. Recently, a cold water leak from the area between the disks to the rotor behind one of the disks resulted in a rotor bow. The 3300 System detected high vibration on the driver side of the refiner (motor driven) and immediately shut down the machine. Upon investigation, the root cause (the leak) was found and a bowed shaft was surmised. The machine was run at low speed while heating the rotor with steam in order to straighten the bow, and the machine was returned to production within one hour. This event occurred less than 4 weeks after the plate clash detection system

installation. Lacking this monitoring system, a more severe failure than a correctable shaft bow would have occurred, and all pulp production to the two paper machines would have been halted for a minimum of 16 hours. *This single event resulted in a return on investment (ROI) for their monitoring system of 156% in just four weeks*, in terms of pulp cost alone. It does not take into account the value of lost steam for processes elsewhere in the plant, which yields an even higher ROI. As a result, the customer will be installing similar systems on two additional refiners later this year.



Venezuela

Bently Nevada was contracted

to manually collect and analyze machinery data from oil extraction facilities in Venezuela at monthly intervals. Our personnel used this data to identify problems on two gearboxes, which ultimately saved the customer in excess of \$150,000 USD. This more than paid for the cost of the Bently Nevada service contract, resulting in a payback time of less than one year. Based on this event, and the increased awareness of the value that machinery data could provide, the customer wisely chose to move to a continuous machinery management system for these machines instead of monthly manual inspections. Bently Nevada installed a Data Manager® 2000 system and rented it to the customer as an interim solution, until they could purchase it from their 2001 budget.

Editor's Note: *Bently Nevada works very flexibly with commercial terms and arrangements for our customers to find innovative solutions to their needs, as illustrated by the above story. We can rent or lease our solutions to customers, in addition to the more traditional outright purchase of our instrumentation. We also provide totally outsourced solutions whereby Bently Nevada retains ownership of all instrumentation and supplies the personnel to operate a machinery management system as a for-fee service.*



United States of America

A large U.S. petrochemical

complex uses a 3500 Machinery Protection System to monitor a critical reciprocating compressor with XY proximity probes observing the plungers. They also have a Data Manager® 2000 condition monitoring system connected to the machine.

When establishing the shutdown logic in the 3500 System, the customer considered the various failure mechanisms that could occur and made certain their alarming strategy could address them. In particular, one failure mechanism was that the plunger could shatter. To detect failures of this nature, the customer activated their gap voltage alarms and programmed the 3500 System's logic to generate a shutdown signal if both X and Y probes were in a gap alarm condition. They also enabled conventional DANGER alarms that would shut the machine down when excessive vibration levels were present.

Just such a condition occurred recently, and the gap voltage alarms from both probes tripped the unit when a plunger shattered. While the 3500 System did its job in shutting the machine down automatically, it also provided earlier indications that were, unfortunately, unheeded. Eight hours prior, the 3500 System had shut the same compressor down due to high vibration alarms. Operators, believing that there was an instrumentation problem rather than a machinery problem, restarted the unit and ran it until the 3500 System again shut the unit down on gap alarm conditions from both probes as noted above.

Editor's Note: *While we wish that every machine shutdown represented a "Synopsis of Savings," it sometimes represents a "Synopsis of Savings Lost" because a failure progressed much farther than it needed to. Was the machine in this story 'saved?' Technically, yes. However, the customer missed multiple opportunities to be proactive. First, operators*

could, and should, have taken action when the initial alarm occurred. The machine was telling them it was in distress, but these indications were ignored under the assumption it was an “instrument” problem, rather than a bona-fide machinery problem. Bently Nevada advocates that customers take all alarms seriously and thoroughly understand why the alarm occurred before they restart or continue to run a machine. Assuming an alarm is an instrument problem, rather than a machinery problem, is generally a very bad assumption. A recent ORBIT article dealing with the issue of relying on a single measurement and assuming alarms are machinery, rather than instrument, problems is worth your attention. (“Relying on a Single Measurement – Guilty Until Proven Innocent,” ORBIT, Vol. 22, No. 1, 2001, p. 55.)

Second, and equally important, the customer had at their disposal an online software system to help manage the machine. At minimum, they should have relied on their Data Manager® 2000 software following the first alarm to understand better what was happening in the machine, possibly providing sufficient information to prevent them from starting the machine again. Ideally, they would have been using their Data Manager® 2000 system to spot changes in the machine’s condition well before the 3500 alarms were activated.

The customer undoubtedly saved some money when the machine tripped automatically, rather than allowing it to continue running after such a catastrophic failure as a shattered plunger. Thus, we’re proud of our machinery protection systems and that they act when required, as this story illustrated. However, we’re even prouder when customers use our machinery management systems to avert such

failure progression. Today’s best machine saves no longer involve automatic machine shutdowns. Instead, they involve prevention of failure altogether by properly managing the machine. [ORBIT](#)

